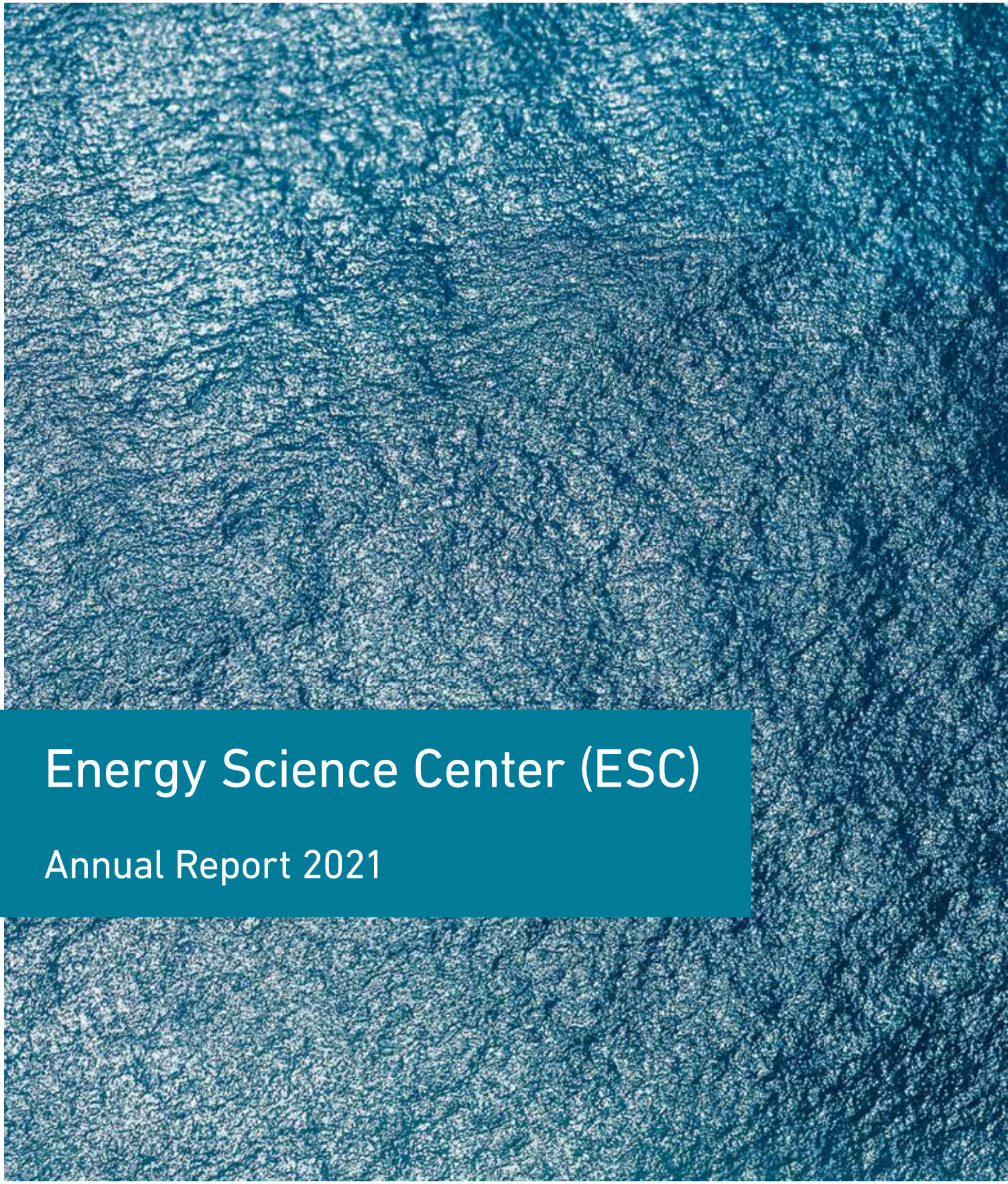
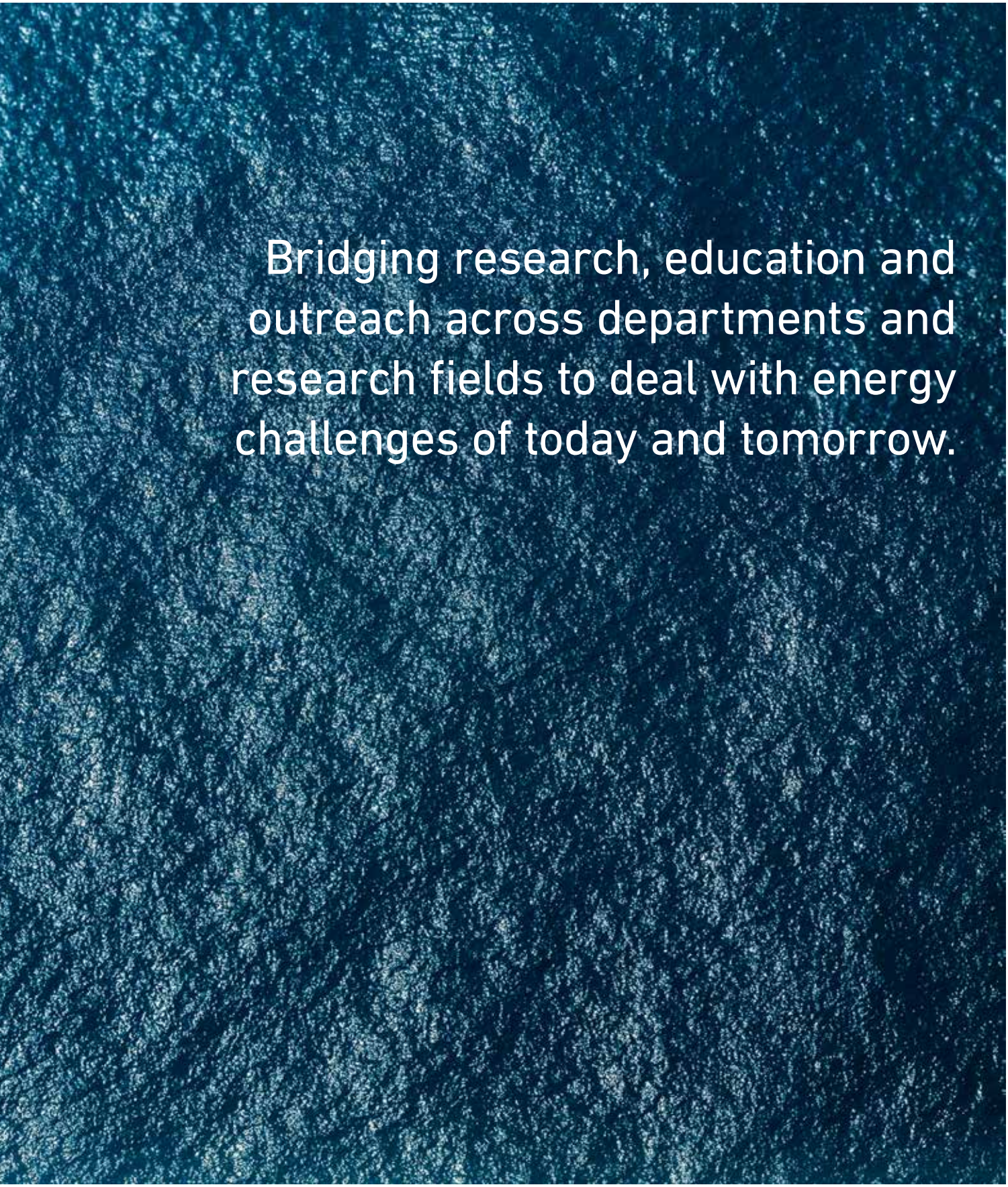


Energy Science Center (ESC)

Annual Report 2021

Energy Science Center



Bridging research, education and outreach across departments and research fields to deal with energy challenges of today and tomorrow.

Table of Contents

Welcome Message

DEAR COLLEAGUES, PARTNERS, AND FRIENDS OF THE ENERGY SCIENCE CENTER,

The year 2021 started with excellent news: Our proposal for the "Swiss Energy Research for the Energy Transition" (SWEET) programme with the title "Pathways to an efficient future energy system through flexibility and sector coupling" (PATHFNDR) was evaluated positively and we were able to start this consortium in May, together with three other successful consortia. Hosted by ETH Zurich, the consortium is represented by eight research partners – ETH Zurich, Empa, PSI, ZHAW, HSLU, UNIGE, EPFL and TU Delft – and 25 cooperation partners. The project aims to develop and analyse transition pathways for renewable energy integration in Switzerland. The project will deliver feasible pathways, provide planning and operation tools, develop pilot and demonstration projects, identify new business opportunities and innovation strategies, and analyse potential policies. In this consortium, we are also integrating the platforms "Renewable Management and Realtime Control Platform" (ReMaP) and the Nexus-e Energy System Modelling platform to be able to build on the strong research foundation the Energy Science Center has built up in the recent years.

We are happy to report the first class of the Certificate of Advanced Studies (CAS) on Applied Technology in Energy: Over 25 students from different professional backgrounds attended classes to get an understanding of energy science and the technical foundations. This "Reverse MBA" type programme helps non-engineers to better understand research and developments in the energy field. Furthermore, it boosts their careers.

As in previous years, 2021 ended on a high note with the "Energy Week @ ETH" in December, where we were able to present our latest insights from research, including the latest scenarios developed with the Nexus-e platform.

Now we look forward to 2022, together for a sustainable energy system!

Gabriela Hug
Chair

Christian Schaffner
Executive Director

The Energy Science Center (ESC)

To tackle the central challenges facing the energy system (i.e. climate change, access to energy services, local pollutants and risks and benefits to society), additional knowledge and new technologies are needed, relying on the expertise and cross-cutting research of engineering, economic and social scientists.

The Energy Science Center (ESC) of ETH Zurich was founded in 2005 as an interdepartmental competence center to facilitate energy research and teaching activities across research fields and departments. In 2021, the ESC continued to integrate specialists and disciplines even further by facilitating interdisciplinary and interdepartmental energy research, teaching and outreach activities. Therefore, the ESC has strengthened its role as a national and increasingly international player in the energy sector.

www.esc.ethz.ch

The Research Center for Energy Networks (Forschungsstelle Energienetze – FEN) is affiliated with the ESC.

www.fen.ethz.ch

Mission

The Energy Science Center (ESC) aims to facilitate the deployment of an environmentally friendly, reliable, low risk, economically viable and socially compatible sustainable energy system.

The ESC enhances cooperation between ETH Zurich, industry, government, and society on energy related issues, offering a platform for nourishing the exchange of information between the engineering sciences and the social sciences as well as for directing joint projects.

The ESC synergistically combines key expertise in various energy disciplines to address large-scale problems successfully and to form flagship projects.

The ESC team at their annual strategy meeting.

Organisational Structure

The **General Assembly**, made up of the ESC members, is the ESC governing body. Currently 54 professors and senior researchers from nine different departments are members of the ESC.

The **Managing Board** is the executive body of the ESC and is composed of seven members elected by the General Assembly. The managing board elects one of its members as chair.

The **Executive Office** is run by the Executive Director, who reports to the chair of the managing board.

The **Advisory Board** comprises representatives from industry and commerce and advises the ESC on its activities.

Partnership Council

The Partnership Council is formed of foundations and industry partners who make substantial donations to the programme of the center through the ETH Foundation, and who are interested in playing an active role in building joint initiatives.

The Center's Partnership Council meets biannually with the ESC Managing Board and Executive Director.

Prof. Dr. Gabriela Hug new Chair of the Managing Board

Since 2021 Prof. Dr. Gabriela Hug is new chair of the Managing Board. She leads the Power Systems Laboratory at the Institute for Power Systems & High Voltage Technology. The other board members are:

- Prof. Dr. André Bardow
- Prof. Dr. Robert Boes
- Prof. Dr. Christian Franck
- Prof. Dr. Volker Hoffmann
- Prof. Dr. Anthony Patt
- Prof. Dr. Arno Schlüter

Members of the Executive Office

Dr. Christian Schaffner

Executive Director

Dr. Gianfranco Guidati

Project Manager ReMaP

Pranjal Jain

Project Engineer Nexus-e

Dr. Kirsten Oswald

Scientific Outreach Manager

Elena Raycheva

Research Assistant
Teaching Assistant

Dr. Marius Schwarz

Project Manager Nexus-e

Katharina Bosina

PR, Communication and Events (a.i.)

Deborah Hufton

Education

Dr. Adriana Marcucci

Project Manager SWEET-CROSS

Lea Ruefenacht

Project Manager SWEET-PATHFNDR

Annina von Mentlen

PR, Communication and Events

New ESC Members in 2021

Dr. Turhan Demiray

Research Center for Energy Networks (FEN)

Turhan Demiray is responsible for the acquisition, lead and implementation of industrial and academic research projects in the field of energy systems. His research interests are modelling, simulation, control, and optimisation of energy systems, in particular electrical power systems.

Dr. Petrissa Eckle

Sustainability in Business Lab (sus.lab)

As leader of sus.lab, Petrissa Eckle combines her passion for building a more sustainable future with her experiences from a PhD in Physics and her work experience in energy systems analysis at PSI and in consulting at McKinsey.

Prof. Dr. Russell McKenna

Energy Systems Analysis

Russell McKenna's research focuses on decentralised multi-energy systems, especially within residential buildings and urban environments. He also has a particular interest in critical analysis of autonomous energy systems – which are currently the topic of much discussion.

Reaccreditation 1 Oct. 2021

We are very happy to announce that the ESC was successfully re-accreditated by the ETH Zurich in October 2021. We look forward to continuing our endeavours over the next four years.

ESC Highlights in 2021

JANUARY

SFOE launches the **SWEET programme**, ETH Zurich being the leading house of the consortium PATHFNDR.

FEBRUARY

MARCH

Gianfranco Guidati joins the ESC executive team as project manager for the ReMaP flagship project.

Public Lecture Series on Sustainable Development Goals, organised by ETH Sustainability

APRIL

The ESC welcomes **Petrissa Eckle and Turhan Demiray** as new members of the competence center.

MAY

The six groups of **MEST students** successfully complete their interdisciplinary case studies.

The **PATHFNDR project successfully kicked-off** in a virtual event with presentations by the project team.

The ESC welcomes **Lea Ruefenacht** and **Pranjal Jain** for the Nexus-e and PATHFNDR research projects.

Adriana Marcucci joins the ESC as Manager Coordination Scenarios for the SWEET programme.

The **PATHFNDR Lunchtalk Series** is launched, presenting the tools and models of the research project.

JUNE

Katharina Bosina joins the ESC team as interim project manager for PR, communication and events.

ReMaP event with overview of the current status and future outlook of the project

Energy Data Hackdays, in collaboration with Zukunftsregion Argovia and Opendata.ch

The ETH energy communiity meets for a networking **Energy Apéro** at ETH's Dozentenfoyer

Fachtagung Elektromobilität in cooperation with VSE

Energy Start-up Day, co-organised by the ESC and ZHAW, investor meetings, talks and pitches

JULY

AUGUST

The ESC team meets for a **strategy barbecue** in the Zurich woods

SEPTEMBER

OCTOBER

Kirsten Oswald joins the ESC as Scientific Outreach Manager responsible for knowledge transfer.

The **ESC Board** welcomes three new members: Gabriela Hug, André Bardow and Christian Franck.

Klimarunde, co-organised by the ESC and C2SM, public conference and discussions with experts

NOVEMBER

DECEMBER

Energy Week @ ETH 2021, graduate symposium, focus dialogues and symposium during four days

Research

Research Approach

The ESC research activities focus on large, cross-cutting themes and span interdepartmental and interdisciplinary projects. In 2021, two flagship programmes that started as strategic initiatives, have been further developed to build the basis for services to the ETH research community and beyond: "Renewable Management and Real-Time Control Platform (ReMaP)" and "Integrated Energy Systems Modelling Platform (Nexus-e)".

This year the ESC also launched the Expert Group initiative to address current hot topics in the energy sector and consolidate research insights for stakeholders outside academia. The goal is to offer practical, feasible and added-value recommendations for integrating knowledge and know-how into different sectors to promote the energy transition. Focus Groups will not conduct research, but rather gather established findings and conclusions and prepare material (e.g. webpage, blogs, factsheets, etc.) for different target groups (e.g. industries active in the energy sector, energy utilities, consumers, prosumers, associations, governmental authorities, etc.).

Another highlight this year were the energy scenarios presented by Gabriela Hug at the Energy Week symposium. Researchers of the Nexus-e platform developed possible energy scenarios to show various transition options towards a climate-neutral Swiss energy system. One main conclusion of this work is that Switzerland needs to expand solar energy capacity rapidly to meet near- and long-term climate targets. Additionally, it may be economically feasible to consider natural gas power plants with carbon capture and storage to ensure security of supply in light of nuclear phase-out.

In general, the ESC identifies relevant topics in the area of energy research. This also includes participation in National Research Programs (NRP) and European Research projects. Research activities consist of:

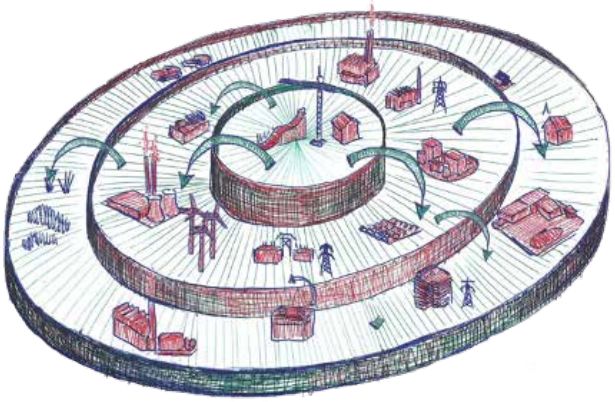
- Taking a proactive role in the energy research activities of ETH Zurich and supporting its strategic goals in all areas of action (efficiency, grids, storage, provision, economy, geothermal energy and more)
- Supporting the professors and institutes active in these fields by leveraging its network inside ETH Zurich with other universities and industry
- Gathering opinions and questions within the energy sector internally and externally, synthesizing and disseminating them amongst researchers of ETH Zurich
- Hosting researchers for specific projects in order to facilitate interdepartmental research projects
- Promoting flagship programmes in the area of energy research

Research Focus

Clean, affordable and reliably available energy is of paramount importance to the well-being of modern societies. Developing future environmentally-friendly energy systems requires research in a large number of scientific disciplines. Most of these are cultivated at ETH Zurich, which has a bright tradition in energy-related research.

Research Projects

Nexus-e: an Energy Systems Modelling Platform



Nexus-e is an Energy Systems Modelling Platform that cuts across the boundaries of established fields of knowledge by combining existing and new tools from various disciplines. With expertise in electrical engineering, political sciences, economics, risk engineering, and management, ETH Zurich is in the unique position to establish such a comprehensive platform. Leveraging this expertise, Nexus-e enables studying the impact of technical, socio-economic, and regulatory developments on the future electricity system.

After completing the first version of Nexus-e in the previous year, 2021 was all about reaping the fruits of our hard work and starting new projects to ensure a continuous development of the platform. A full article published on the eTrends magazine described our journey until completing the first version of Nexus-e

Then, especially the kick-off of the two long-term SWEET projects PATHFNDR and EDGE, both in which Nexus-e plays a key role, have been a great success story. PATHFNDR (PATHways to an Efficient Future Energy System through Flexibility aND SectoR Coupling) aims to develop and analyse transition pathways for renewable energy integration in Switzerland. As the central tool for the consortium, Nexus-e will provide the scenarios, considering technical, economic and social constraints for the national scale and regional scale. In the context of the PATHFNDR virtual lunch talk, Dr. Marius Schwarz (project manager of Nexus-e) presented the platform to involved research and industry partners. SWEET EDGE (Enabling Decentralized renewable GEneration in the Swiss cities, midlands, and the Alps) aims to fast-track the growth of locally-sourced decentralized renewable energy in Switzerland. This will ensure that by 2035 and 2050, when ambitious shares of renewable energy are reached, the Swiss energy system is designed and operated in a technically and economically optimal as well as secure way, and that it is well positioned in the European markets. Besides model devel-

Nexus-e annual strategy meeting 2021 at Impact Hub.

opments, Nexus-e also takes place in a model comparison in the context of EDGE. In 2021, a first comparison allowed the researchers of the three participating models to improve model assumptions and data.

2021 was also a year of new team members. We are very happy and proud to welcome Prof. André Bardow on board and are excited for the upcoming collaboration with him and his team. Prof. Bardow has been full professor for Energy and Process Systems Engineering (EPSE) at ETH Zurich since 2020. A key milestone in this collaboration is the coupling of the energy system optimization model "SecMOD" with the Nexus-e modelling platform. Ludger Leenders joined the Nexus-e team as a researcher and will be responsible for the integration of SecMOD into the Nexus-e framework. Also, Dr. Mengshuo Jia, Post-Doc in the Power System Laboratory, joined Nexus-e in 2021 and brings in his expertise in power flow modelling.

Another highlight of last year was Prof. Gabriela Hug's presentation at the ETH Energy Week on the topic "Climate Neutral Switzerland 2050: What System Do We Need?" She presented three key learnings based on Nexus-e scenarios: Solar power is responsible for by far the largest addition to electricity generation capacity in Switzerland. Electricity trade with neighbouring countries is important today and will remain important in the future. Switzerland needs flexible power generation in winter in the long term. The recording and slides of Prof. Hug's presentation, an ETH news article about the Energy Week as well as an interview with Prof. Hug in the Swiss newspaper "Tagesanzeiger" are available online.

For the coming years, we aim to keep up the current pace of development and output. Further, we envision Nexus-e to serve as a modelling infrastructure that is used widely in education and simplifies interdisciplinary research within ETH Zurich.

www.nexus-e.org

Renewable Management and Real-Time Control Platform (ReMaP)

ReMaP event on 28 September 2021 at Paul Scherrer Institute, PSI.

The main objective of the ReMaP project is to provide a platform that allows the interaction of diverse energy conversion and storage technologies to be tested and demonstrated in a realistic environment. This platform builds on and extends the NEST/move/ehub demonstrators at Empa and the Energy System Integration (ESI) platform at PSI. Additional objectives of the ReMaP project are the use of the platform for (1) educating students in decentralized renewable energy systems and (2) informing decision makers and the public about the importance and the development of such systems.

Using a cloud-based infrastructure, the platform allows researchers to carry out experiments with hardware at NEST/move/ehub and ESI and as well as simulations of the hardware. In addition, the platform permits the

exchange of information between the experiments and simulations and therefore enables hardware-in-the-loop simulations. Data from the experiments and simulations are stored in a dedicated archive, permitting its later use in simulations as well as model formulation and validation.

The software and hardware architecture is fully operational, the interaction of the modelling and control framework involving hardware elements at EMPA, PSI and ETH Zurich could be demonstrated in three different experiments. These were related to the flexible operation of a combined heat and power plant, the integration of an electrolyser in a high power electric vehicle charging station, and the usage of electrolysis and methanation for seasonal electricity storage. More experiments are planned on the optimal control of distribution grids with high shares of photovoltaic generation.

The platform is designed to allow the integration of further demonstrators and to serve as a flexible and modular simulation tool. This option is currently being evaluated with academic partners from various institutions. ReMaP will also play a pivotal role in the SWEET project PATHFNDR that is also be managed by the ESC.

www.remap.ch

ReMaP partners

- Empa
- PSI
- Adaptricity
- Smart Grid Solutions
- Supercomputing Systems
- National Instruments

ReMaP event on 28 September 2021 at Paul Scherrer Institute, PSI

Pathways to an efficient future energy system through flexibility and sector coupling (PATHFNDR)

PATHFNDR is one of four research projects funded by the Swiss Federal Office of Energy (SFOE) as part of the "SWEET" programme (Call 1-2020) on «SWiss Energy research for the Energy Transition». The PATHFNDR consortium consists of eight research partners – ETH Zurich, Empa, PSI, ZHAW, HSLU, UNIGE, EPFL, and TU Delft – under the lead of the ETH Zurich where the Energy Science Center (ESC) provides the home base. In close collaboration with the SFOE, the other three SWEET consortia, and 25 cooperation partners from the private and public sector, the PATHFNDR consortium aims for an efficient, flexible, resilient, cost-effective, and sustainable Swiss energy system by 2050. The main project goal is to develop and analyse transition pathways for integrating renewable energy in Switzerland. For this purpose, we focus on improving the performance of energy systems, enabling flexibility options, and fostering sector coupling.

In May 2021, the project was launched by André Bardow, director of PATHFNDR and ETH professor of Energy and Process Systems Engineering, and Christian Schaffner, deputy director of PATHFNDR and Executive Director of the ESC at ETH Zurich. The management team established the project's advisory board, steering committee, and executive board, which are in charge of the strategic, operational, and scientific coordination. Currently, the research team develops future scenarios and defines metrics to assess the impact of the energy transition through sustainability (including energy efficiency and share of renewables), sector coupling, and flexibility. The evaluation of these scenarios will be enabled by advancing specialized tools and models (e.g. ReMaP, Nexus-e, SecMOD, Calliope) as well as integrating demonstrators (e.g. NEST, move, ESI) across Switzerland. By the end of 2022, two proposals for implementing first results in pilot and demonstration projects will be submitted to the SFOE.

Until 2027, the project will deliver feasible pathways for the energy transition at international, national to city, and district scales that enhance flexibility and sector coupling. In addition, PATHFNDR will provide planning and operation tools as well as demonstrate technologies and market designs for exploiting the flexibility of local resources. Furthermore, new business opportunities and innovation strategies will be identified to use novel flexibility and sector coupling options. Finally, potential policies for the energy transition and decarbonization of the Swiss energy system will be assessed. Information, news and events are regularly posted on the project website.

www.sweet-pathfndr.ch

PATHFNDR partners

- ETH Zurich
- Empa
- Paul Scherrer Institute (PSI)
- Zurich University of Applied Sciences (ZHAW)
- Lucerne University of Applied Sciences and Arts (HSLU)
- University of Geneva (UNIGE)
- Swiss Federal Institute of Technology Lausanne (EPFL)
- Delft University of Technology (TU Delft)

PATHFNDR kick-off meeting on 31 May 2021.

Coordination of Scenarios for the SWEET Programme (SWEET-CROSS)

CROSS (CooRdination Of Scenarios for SWEET) is a joint activity of the four consortia DeCarbCH, EDGE, PATHFNDR and SURE, supported by the SWEET programme of the Swiss Federal Office of Energy (SFOE) and coordinated by the Energy Science Center. The objective of CROSS is to ensure that results from scenario simulations from the four consortia can be made comparable and that credible conclusions can be drawn.

CROSS started in May 2021. The activity began by establishing the concept and needed tasks to achieve the activity's goal: creating a platform for communication of data and results within the SWEET consortia, to the scientific and public domain; jointly defining the CROSS scenarios to be analysed by all SWEET consortia; harmonising a basic set of input parameters across consortia to improve the relevance and comparability of the results; and building a catalogue with information about SWEET models and research groups.

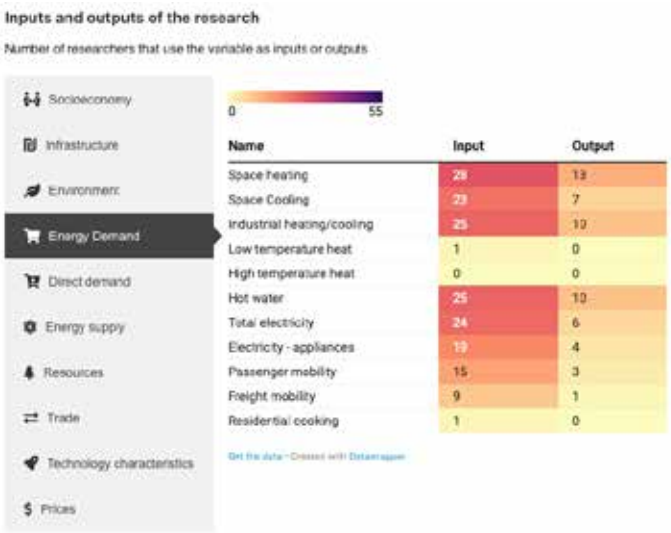
During 2021, we carried out a survey on data and simulation models with all SWEET partners. With the survey

responses, we created the CROSS catalogue and determined the structure of the CROSS data hub.

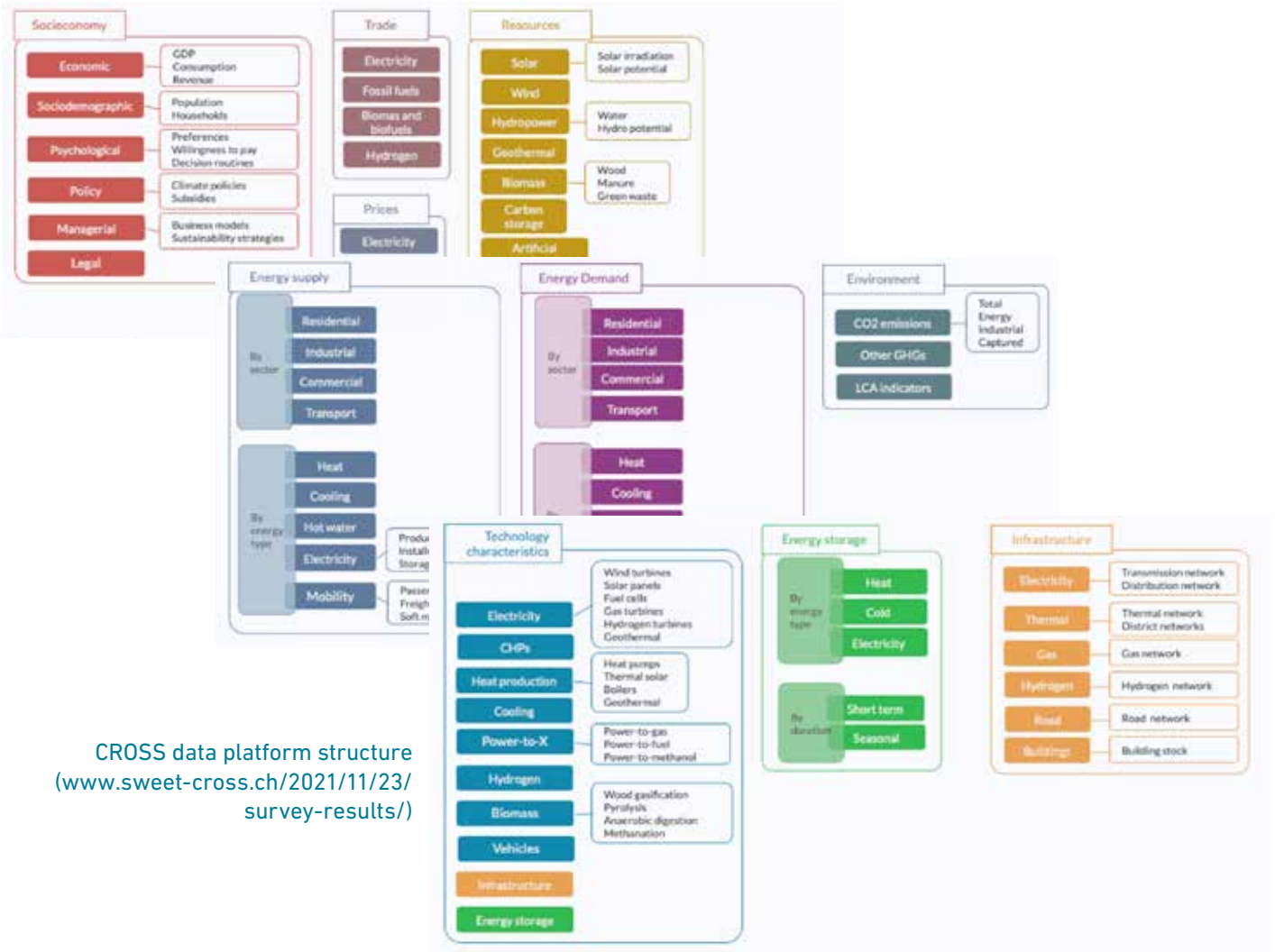
The CROSS catalogue (www.sweet-cross.ch/catalog) includes the documentation of over 40 simulation models and research groups from all SWEET consortia. The documentation contains an extensive overview of inputs, outputs and capabilities from the models and groups. Currently, we are working on developing the harmonized scenarios and the data hub.

CROSS will complete its activities by the end of 2022. The SFOE will continue this activity with a larger research project that will run for 10 years. Moving towards open science, all outcomes produced during this first phase are well documented and open source, so that they can easily be used by the new consortium.

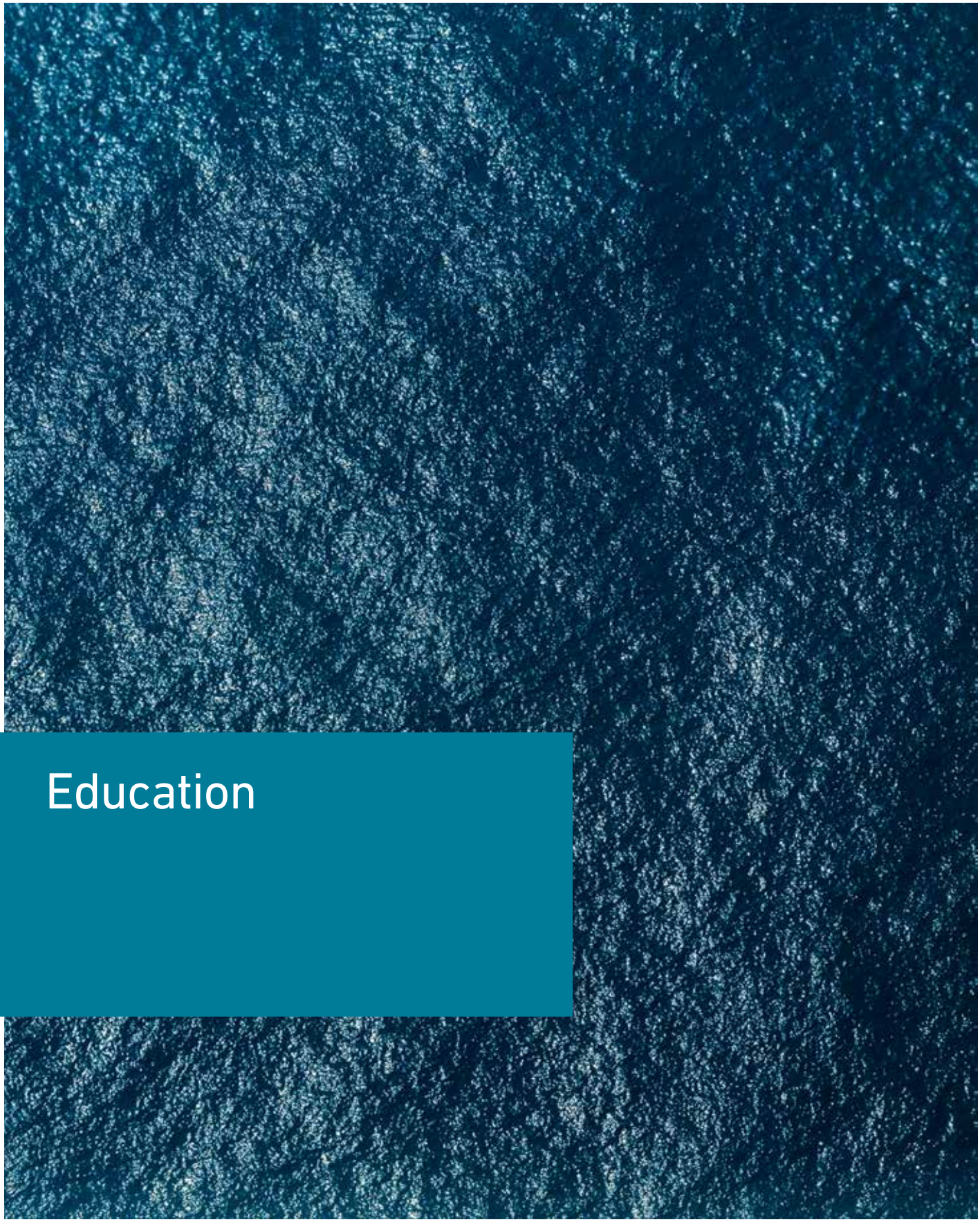
www.sweet-cross.ch



Responses of CROSS survey
(www.sweet-cross.ch/2021/11/23/survey-results/)



CROSS data platform structure
(www.sweet-cross.ch/2021/11/23/survey-results/)



Education

Master Energy Science and Technology (MEST)

The ESC coordinates the interdisciplinary Master's programme Master Energy Science and Technology (MEST) at ETH Zurich, a world-class Master's programme for energy engineers, aimed at students with an engineering or a technological science background. MEST continues to offer a specialised programme of a unique type, enabling study across a wide range of energy-related courses offered by ETH Zurich and providing students with the academic skills required by the energy marketplace.

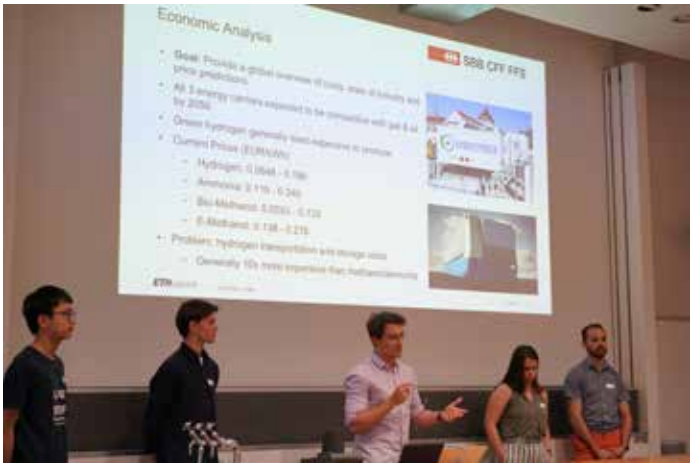
The joint programme between D-ITET and D-MAVT has been running since 2007 and is a well sought-after interdisciplinary Master's programme at ETH Zurich. A further nine departments actively contribute to the MEST through tutors and their offer of nearly 50 energy-related core courses.

The fundamental aspects of energy science and technology are covered by a range of compulsory courses in the three academic areas of electrical power engineering, energy flows and processes, and energy economics and policy; elective courses can be selected from any energy-related course within the ETH course catalogue.

A unique aspect of the MEST programme is an innovative course that provides the students with the experience of working on real-world problems currently faced by companies within the energy sector, thereby linking industry and academia. These problems cover some of the technical, economic and regulatory aspects of the challenges of building a sustainable energy system for the future. The students work together in teams, and present their final work to the whole class and industry partners.

As predicted, the dip in the number of 2020 entrants caused by Covid-19 meant a larger than usual intake (44) in 2021. Offering a buddy to all the new incoming students, an idea initiated by a current student, was instigated and warmly received. Responding to the changing Covid-19 restrictions required some creativity, including holding outdoor meetings.

www.master-energy.ethz.ch



MEST "Case Studies: Energy Systems and Technology" final presentations and apéro.

MEST student facts 2021

- 180 applications received
- 70 places offered
- 44 students enrolled
- 9 from Switzerland
- 21 from Europe
- 14 from the rest of the world
- 7 female students
- 37 male students
- enrolment up by 70% compared to 2020

MEST Alumni Support and Career Development

MEST Alumni connects more than 300 graduates of the Energy Science and Technology Master's programme. Our members from all over the world keep in touch with one another through physical and virtual events and online platforms. We aim to create a network that our members benefit from by leveraging the interdisciplinary character of the MEST programme, sharing expertise and job opportunities in various industries and locations.

www.alumni.ethz.ch/en/mitgliederorganisationen/ingenieurwissenschaften/master-energy-science-and-technology--mest--alumni.html

Master Integrated Building Systems (MBS)

The ESC supports the interdisciplinary Master's degree programme in Integrated Building Systems (MBS) at ETH Zurich. The Chair of the Board and the Executive Director of the ESC are members of the admission committee and were on the advisory committee during the initial planning phase of the master's programme.

This programme provides a science-based education in building systems and technologies with a strong emphasis on the energy performance and the environmental impact of buildings. The emphasis is on the integration of sustainable energy technologies at both the building and the urban level.

www.master-buildingsystems.ethz.ch

Graduate Symposium Energy Week @ ETH 2021

As part of Energy Week @ ETH, 32 PhD students teamed up to explore the topic "Rethinking Tomorrow's Energy Landscape" on 30 November 2021. The goal of the symposium was to offer a platform for students to broaden their horizon by interacting with people from different backgrounds and experience a full design thinking process. They also heard from energy start-ups to understand their current challenges, defined a relevant problem within the energy space with their team, and then developed, prototyped and pitched a solution at the end of the day.

Graduate Symposium on 30 November 2021 at Impact Hub.

Graduate Symposium on 30 November 2021 at Impact Hub.

CAS Programme Applied Technology in Energy

ETH Zurich's continuing education programme CAS Applied Technology in Energy (CAS ATE) is part of the Master of Advanced Studies in Applied Technology (MAS AT), together with other CAS courses. The CAS ATE is designed to provide managers with a deeper education in the rapidly evolving world of energy and electrification. It's a so-called "Reverse MBA". It helps participants to better understand the ongoing energy transition and enable them to shape the energy future of their company and industry. The first round took place in 2021 with 12 participants.

The MAS AT is a continuing education programme offered by D-ITET in cooperation with multiple departments and research centers at ETH Zurich. Within the MAS AT, ESC executive director Dr. Christian Schaffner is programme co-director of the CAS ATE. Furthermore, the ESC and its staff contribute directly to two modules within the CAS ATE, one of which is an online module to transfer the basics of energy engineering and systems.

www.mas-at.ethz.ch/cas-programs/cas3a.html.html

Frontiers in Energy Research

Frontiers in Energy Research is a series of lectures which disseminates knowledge of ETH Zurich energy-related research activities throughout the research community. Each lecture is given by a different PhD student who is at an advanced stage of their research, and attended by any PhD students interested in this area. The seminars have been held annually since 2012 with 14 lectures each spring semester. At the end of the semester, a "Best Frontiers Presenter" award is given based on the audience feedback. In spring 2021, the 39 attendees and presenters came from 7 different ETH departments, plus PSI & EMPA. The lectures were successfully transferred from lecture hall to an online format, with no loss of impact on the presentations or attendees during Covid-19 restrictions.

www.esc.ethz.ch/events/frontiers-in-energy-research.html

Outreach

ESC Events

Energy Week @ ETH 2021

30 November - 3 December 2021

On the first day of the Energy Week @ ETH selected PhD students and young researchers had the opportunity to engage in a design thinking process on the topic of "Rethinking Tomorrow's Energy Landscape".

On the second day, experts from science, politics and industry presented and discussed newest insights on the topic "Climate Neutral Switzerland 2050: What Energy System Do We Need?". Along with inputs about "Energy scenarios for a climate-neutral Switzerland" and "Technological requirements for a sustainable energy system", the audience gained insights into political decision processes as well as innovation processes of energy start-ups.

On the last two days the "Focus Dialogues" took place covering the topics of "Seasonal energy storage", "Sector coupling: electricity, heat and gas", "Hydrogen as energy storage" and "Automation of electricity grids".

www.esc.ethz.ch/events/energy-week-2021.html

Impressions from Energy Week @ ETH 2021.

ETH Energy Apéro

1 November 2021

The ETH Energy Apéro is a social event for anyone involved in the ETH energy community. Professors, researchers, doctoral students and masters students were invited. The event recapped and honoured successes from the previous year, many of which had been dinted by the Covid-19 restrictions.

ETH Energy Apéro.

ESC Collaborations

Energy Data Hackdays

24 September 2021

During the Energy Data Hackdays in Brugg, the ESC challenged an interdisciplinary team into rethinking ways of visualising existing energy data. In a rapid and creative process and under the guidance of ESC team members, a team of four successfully tackled the posed challenge and presented a well-functioning prototype after only 30 hours.

Impressions from the Energy Data Hackdays.

Klimarunde 2021

26 October 2021

The Klimarunde is a public ETH event organized by C2SM (Center for Climate Systems Modelling) in collaboration with ESC. For the 8th time, we brought together general audience (over 400 participants!) and experts from climate-related sciences and created space for education and discussion. The topic of the Klimarunde 2021 was "Net-zero: How do we achieve carbon neutrality?".

Energy Start-up Day

4 November 2021

The Energy Start-up Day is a yearly event connecting Swiss start-ups to incumbent companies, public institutions and new actors to foster relationships and collaborations in the sectors of energy, cleantech, mobility and smart buildings. The ESC is an institutional partner and the event is organised by ZHAW School of Management and Law, Institute of Innovation and Entrepreneurship.

E-Mobility Conference

16 November 2021

This conference (Fachtagung Elektromobilität) was organised in collaboration with the Verband Schweizerischer Elektrizitätsunternehmen (VSE). Experts and participants discussed opportunities and challenges regarding the integration of e-mobility in existing and future electricity grids. Dr. Marius Schwarz presented Nexus-e scenarios on the impact of electric vehicles and their charging loads on the Swiss electricity system.

Annex

54 active members (as of December 31, 2021)

D-ARCH
Prof. Dr. Andrea Deplazes
Prof. Dr. Arno Schlüter

D-BAUG
Prof. Dr. Robert Boes
Prof. Dr. Paolo Burlando
Prof. Dr. Eleni Chatzi
Prof. Dr. Daniel Farinotti
Prof. Dr. Olga Fink
Prof. Dr. Guillaume Habert
Prof. Dr. Stefanie Hellweg
Prof. Dr. Martin Raubal

D-CHAB
Prof. Dr. Gonzalo Guillén Gosálbez
Prof. Dr. Maksym Kovalenko
Prof. Dr. Thomas Schmidt
Prof. Dr. Jeroen A. van Bokhoven

D-ERDW
Prof. Dr. Domenico Giardini
Prof. Dr. Johan Robertsson
Prof. Dr. Martin Saar
Prof. Dr. Stefan Wiemer

D-GESS
Prof. Dr. Tobias Schmidt
Prof. Dr. Bjarne Steffen
Prof. Dr. Andreas Wenger

D-ITET
Prof. Dr. Jürgen Biela
Prof. Dr. Florian Dörfler
Prof. Dr. Christian Franck
Prof. Dr. Ulrike Grossner
Prof. Dr. Gabriela Hug
Prof. Dr. Johann Kolar
Prof. Dr. John Lygeros
Prof. Dr. Roy Smith
Prof. Dr. Ayodhya Nath Tiwari
Prof. Dr. Vanessa Wood

D-MAVT
Prof. Dr. André Bardow
Dr. Turhan Demiray
Prof. Dr. Paolo Ermanni
Prof. Dr. Lino Guzzella
Prof. Dr. Maria Lukatskaya
Prof. Dr. Edoardo Mazza
Prof. Dr. Marco Mazzotti
Prof. Dr. Christoph Müller
Prof. Dr. Nicolas Noiray
Prof. Dr. David Norris
Prof. Dr. Christopher Onder
Prof. Dr. Dimos Poulikakos
Prof. Dr. Giovanni Sansavini
Prof. Dr. Aldo Steinfeld
Prof. Dr. Melanie Zeilinger

D-MTEC
Prof. Dr. Lucas Bretschger
Dr. Petrissa Eckle
Prof. Dr. Massimo Filippini
Prof. Dr. Elgar Fleisch
Prof. Dr. Volker Hoffmann

D-USYS
Prof. Dr. Reto Knutti
Prof. Dr. Anthony Patt
Prof. Dr. Sonia I. Seneviratne
Prof. Dr. Michael Stauffacher
Prof. Dr. Bernard Wehrli

Managing Board (as of December 31, 2021)

Prof. Dr. Gabriela Hug
Prof. Dr. André Bardow
Prof. Dr. Robert Boes
Prof. Dr. Christian Franck
Prof. Dr. Volker Hoffmann
Prof. Dr. Anthony Patt
Prof. Dr. Arno Schlüter

Executive Office (as of December 31, 2021)

Dr. Christian Schaffner - Executive Director
Katharina Bosina - PR. Communication and Events (a.i.)
Dr. Gianfranco Guidati - Project Manager ReMap
Deborah Hufton - Education
Pranjal Jain - Project Engineer Nexus-e
Dr. Adriana Marcucci - Project Manager SWEET-CROSS
Dr. Kirsten Oswald - Scientific Outreach Manager
Elena Raycheva - Research and Teaching Assistant
Lea Ruefenacht - Project Manager SWEET-PATHFNDR
Dr. Marius Schwarz - Project Manager Nexus-e
Annina von Mentlen - PR, Communication and Events

Partnership Council (as of December 31, 2021)

ABB Schweiz
Alpiq
Axpo
Swiss Federal Office of Energy (SFOE)
BKW
CKW
EKZ
ewz
GE Power
Repower
Shell
Werner Siemens Stiftung

ETH Zurich
Energy Science Center (ESC)
Sonneggstrasse 28
8006 Zurich

www.esc.ethz.ch

Publisher: Energy Science Center (ESC)
Editorial staff: Energy Science Center (ESC)
Layout: Energy Science Center (ESC)
Photo credits: Energy Science Center (ESC)